

The background of the slide is a photograph of a beach. In the foreground, a person is crouched in the shallow water, possibly collecting a sample. The beach is sandy and extends to the water's edge. In the background, there is a steep, rocky cliff with some vegetation. The sky is clear and blue.

MANAGEMENT OF PATHOGENS ASSOCIATED WITH STORM DRAIN DISCHARGE

Results of investigations of the presence of
human pathogens in urban storm drains

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A background photograph of a beach scene. In the foreground, several people are visible on the sand and in the shallow water. In the mid-ground, there are some buildings and structures, possibly part of a beach facility or residential area. The sky is clear and blue. The overall image has a slightly grainy, vintage quality.

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ORANGE COUNTY COMMENTARY

Dirty Ocean Not an Option

By MATT HAGEMANN and LINWOOD PENDLETON

There's an eerie uncertainty among Orange County beachgoers, government regulators and city officials after spring surf brought a monthlong closure to half a mile of Huntington State Beach.

Despite five years of study and the expenditure of more than \$8 million, the question that remains unanswered is "Why are our beaches so filthy?"

After passage of a 1997 law that required regular testing of water at state beaches, officials quickly found all was not well in Surf City.

Beach Postings

	San Diego	Los Angeles	Orange
1999	97	109	136
2000	274	325	283
2001	187	263	345

Beach Closures

	San Diego	Los Angeles	Orange
1999	32	6	21
2000	47	6	40
2001	58	6	51

Posted Days

	San Diego	Los Angeles	Orange
1999	617	406	887
2000	2,450	1,150	2,376
2001	855	1,204	10,515

Waterborne Diseases of Concern in the United States

Viral hepatitis (hepatitis A)

Viral gastroenteritis (Norwalk agent, rotavirus)

Campylobacteriosis (*Campylobacter jejuni*)

Cholera (*Vibrio cholerae*)

Shigellosis (*Shigella* spp.)

Salmonellosis (*Salmonella* spp.)

Typhoid fever (*Salmonella typhi*)

Amebiasis (*Entamoeba histolytica*)

Giardiasis (*Giardia lamblia*)

Cryptosporidiosis (*Cryptosporidium parvum*)



Indicator Organisms

Reliable indicator of the probable presence of pathogens

Indicator concentrations significantly greater than pathogen concentrations

Methods of indicator identification are simple

Estimation of indicator concentration is simple

Ambient Water Quality Standards for Marine and Fresh Waters Used for Full Contact Recreation, MPN/100 mL

Total Coliforms

Single sample	10,000
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Geometric mean	1,000
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Fecal Coliforms

Single sample	1,000
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Geometric mean	100
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Enterococcus spp.

Single sample	104
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Geometric mean	35
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Reliability of Indicators

Resident soil populations have been found

Indicator organisms have been shown to

grow and reproduce in plants

Survival times in water are not always greater

than pathogens

Indicators are not a good model for viruses or

protozoans

Carrolton, GA 1987: 13,000 cases of

Cryptosporidiosis - no coliform violations

Milwaukee, WI 1993: 403,000 cases of

Cryptosporidiosis - no coliform violations

Does indicator monitoring protect the health of recreational water users?

- Develop pathogen monitoring capability using molecular techniques (polymerase chain reaction or PCR)

- Conduct baseline studies that included parks, residential lawns, roofs, and drains

- Conduct field studies of dry and wet weather flows in urban drains

- Conduct field studies of storm runoff from highway facilities

Pathogens Monitored

Adenovirus

Enterovirus

Hepatitis A

Rotavirus

E. coli ETEC

E. coli O157:H7

Shigella spp.

Salmonella spp.

Staphylococcus
aureus

Cryptosporidium
parvum

Giardia lamblia

Adenovirus

Camino Park Barranca	drain	wet
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Davis (park)	paved	dry
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Davis (residence)	soil	dry
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Encinitas (Moonlight)	drain	dry
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Sacramento	drain	dry
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San Diego (Del Mar)	drain	dry
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Culver/405 (Orange Co)	drain	dry
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Enterovirus

San Diego (La Jolla)

drain

dry

Hepatitis A

No positives

Rotavirus

No Positives

E. coli ETEC

El Camino/78	drain	wet
Filmore/210	BMP	wet
Malibu Creek	drain	dry
Montiel/I5	drain	wet

E. coli O157:H7

No Positives

Shigella spp.

No Positives

Salmonella spp.

Malibu creek

drain

dry

San Diego (residence) paved

dry

Encinitas/ I 5	drain	dry
June Way/Hwy 60	BMP	wet
Malibu Creek/101	drain	dry
Malibu Creek/101	drain	dry
Malibu Creek/101	drain	dry
Malibu Creek/101	drain	dry
Rincon/210	BMP	wet

Staphylococcus aureus

Davis (park)	soil	dry
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San Diego (residence)	paved	dry
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Giardia lamblia

Davis (park)	soil	dry
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Cryptosporidium parvum

San Diego (Del Mar)	drain	dry
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Conclusions

Pathogens are in the urban environment

We are about as likely to come in contact with pathogens at the park as in urban drainage

Coliforms, fecal coliforms, and *Enterococcus* are not satisfactory indicators of contamination in the urban environment

Quantitative PCR methods development is highly desirable